

20-12 SITE SEISMICITY FOR EXISTING AND TEMPORARY BRIDGES CARRYING PUBLIC VEHICULAR TRAFFIC

Memo to Designers 9-3 requires that when widening a bridge, the existing structure be evaluated, and upgraded if necessary, to meet current seismic retrofit standards and performance goals. Similar evaluations may be required when other bridge modifications are being designed.

The following criteria are to be used to determine site seismicity for existing ordinary bridges, bridges under temporary conditions including staged construction or partial demolitions, and temporary bridges, which carry public vehicular traffic. Project specific site seismicity requirements shall be determined for "Important" bridges. New ordinary bridges and ordinary bridge widenings shall continue to be designed according to the provisions of Caltrans Seismic Design Criteria using standard deterministic methods.

There are many issues to be considered with regard to site seismicity including deterministic and probabilistic seismic events, attenuation methods, near fault influences, performance goals, ductility, etc.

Bridge site seismicity criteria are determined by a number of conditions including:

Earthquake magnitude	Distance to fault
Soil type	Fault type
Post-earthquake performance	Original design standards
Exception categories	

With consideration for these conditions, a seismic review and analysis shall be performed in accordance with the following:

I. Existing Ordinary Bridges

A. *Minor Modifications:*

Existing Ordinary Bridge for which:

- No substructure modifications are required
- Mass is not increased by greater than 10% due to the modification
- Fixity conditions are not modified

- Peak Bedrock Acceleration has not changed since the bridge was screened, or a comprehensive seismic retrofit was performed, as part of the Phase II Seismic Retrofit Program*
- Factors significantly affecting the spectral acceleration or seismic response, including near fault effects and liquefaction, have not been identified since the bridge was screened, or a comprehensive seismic retrofit was performed, as part of the Phase II Seismic Retrofit Program**

For structures meeting these conditions, neither a seismic review nor seismic analysis is required. However, designers should address seismic demands created by the modifications on local components (e.g. seismic demands on overhangs when adding soundwall to an existing bridge).

B. Widenings and Other Major Modifications:

For existing bridges associated with widenings or other modifications not meeting the criteria for minor modifications listed above:

1. Existing Ordinary Bridge Not Previously Retrofitted[†]:
 - Perform seismic review including the review of As-Built details and geotechnical data.
 - If the review is inconclusive, perform seismic analysis using standard deterministic methods, as outlined in the Caltrans Seismic Design Criteria (SDC) Section 6.1.
2. Existing Ordinary Bridge Previously Retrofitted[†] or Designed Post-1990:
 - Perform seismic review including the review of As-Built details and geotechnical data.
 - If the review is inconclusive, perform seismic analysis using standard deterministic methods, as outlined in the Caltrans Seismic Design Criteria (SDC) Section 6.1.
 - If deterministic methods indicate seismic retrofit is needed, and the bridge is not required to provide post-earthquake performance to meet emergency response needs due to its location on a Life Line Route, then investigate bridge performance using probabilistic ground motions. Probabilistic ground motions shall be based on a

* This data is available from the Office of Earthquake Engineering

** This data is available from the Office of Geotechnical Earthquake Engineering

[†] “Previously Retrofitted” refers to bridges which have received a comprehensive total bridge retrofit, including an assessment and retrofit of the substructure as required.



20% probability of exceedance in 100 years to determine Safety Evaluation seismic demands, as approved by the responsible Office Chief.

If the designer deems that an existing structure is seismically vulnerable, a retrofit Strategy Meeting should be held. Attendees at the Strategy Meeting should include representatives from Structure Design, Earthquake Engineering, Geotechnical Earthquake Engineering, and Maintenance & Investigations. In addition, a representative from the District should be invited.

The purpose of the Strategy Meeting is to determine the need for seismic retrofitting. The proposed strategy must meet the Caltrans "no collapse" seismic retrofit and performance criteria without incurring unnecessary design and construction costs. If the results of the Strategy Meeting conclude that seismic retrofit of an existing structure is required, the responsible Office Chief will provide direction on the appropriate course of action.

II. Temporary Bridges or Bridges Under Temporary Conditions Carrying Public Vehicular Traffic[‡]:

Site seismicity shall be based on a probabilistic ground motion with a 10% probability of exceedance in:

- Twice the number of years that the temporary structure or condition is expected to exist.
- But not less than 10 years.

The lateral seismic design load determined above shall not be less than 0.1g.

For the provisions of this memo, temporary shall be defined as a period not to exceed 10 years. Temporary bridges or bridges under temporary conditions with an expected duration longer than 10 years shall use standard deterministic methods as outlined in the Caltrans Seismic Design Criteria (SDC) Section 6.1 to perform seismic analysis.

[‡] See Memo to Designers 15-14, "Loads for Temporary Highway Structures" for temporary bridges not carrying public vehicular traffic.

Original signed by Richard D. Land

Richard D. Land

Deputy Chief, Division of Engineering Services,
Structure Design

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